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West Europe Report

SCIENCE AND TECHNOLOGY

(FOUO 1/80)

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FRANCE

ENGINEERS DEVELOP NEW 'RECTILINEAR' AUTO ENGINE

Paris LE NOUVEL OBSERVATEUR in French 22-28 Oct 79 pp 73-75

[Article by Gerard Bonnot]

[Text] Have the wars of religion come to an end? To come out finally from limbo, will the electric automobile be converted to gas?

Georges Delapalme, Research Director at Elf-Aquitaine, believes this. He told me so, assuring me that he held in his hands the master trump. He was speaking that day before the French Association of Petroleum Engineers. He explained to his audience that his company was not content to conduct researches on the discovery and operation of petroleum deposits. Nothing concerning petroleum is alien to it. The proof is that it is taking part within a group of economic interests, in the development of a revolutionary engine, an engine consuming gas and generating directly electricity.

"Personally, I find the announcement a little premature," complains Gerard Faul, of the Schneider Company, director of the group concerned, christened Mothelec. "They did not wait for the wedding to drink the champagne. But anyway, it is true, that there is a promise of marriage."

For the miracle engine really does exist. It operates in the laboratory, and will soon be perfected.

It was invented by two independent engineers, the brothers Jacques and Jean Jarret, two men who are past 50, and whose reputation in industrial circles, is assured. They perfected the hydrostatic brakes which equip today the French nuclear submarines. Passionately interested in avant garde techniques, they have long worked on the replacement on wheeled vehicles, of the mechanical or electromechanical transmissions by electronic controls. Thus they were able to sell to a Japanese company the license for electric motors to equip the wheelchairs for the disabled.

In 1968, because it was in fashion, they tackled the pollution by automobiles, on the basis of the principle that the combustion of a molecule of gas, at least in theory, should only generate heat, water vapor and carbon dioxide.

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What is the origin of the toxic products? First of all, from the high temperatures, above 1,500 degrees causing the formation of nitrogen oxide. Then the low oxygen content of the mixture of air and gas. The mixture is not totally burnt, and instead of carbon dioxide, carbon monoxide is produced, which is a deadly poison.

To operate at lower temperatures, to have total combustion of the mixture, the piston stroke would have to be lengthened, and the difference in volumes increased in the combustion chamber, between the ignition time and the dead time at the end of the expansion. Would that be possible? The Jarret brothers calculate and observe that it is not. No connecting rod could resist the mechanical effort thus imposed on it.

Now in the classical internal combustion engine, the connecting rods have four vital functions: start, drive back the piston at the end of the stroke, coordinate the movements of the pistons in the various cylinders, and especially, transform into movement the energy produced in the explosion.

The Jarret brothers, who have no doubts about anything, decide to manage without connecting rods. To drive back the pistons, they would use hydraulic springs. And to assure the other three functions, they would resort to electricity. Thus the idea of the so-called "rectilinear" engine is born.

No One on the Track

It is a cylinder closed at both ends by mobile pistons. The explosion at the center of the cylinder draws apart the pistons, which are then brought together by hydraulic springs. The Jarret brothers adopted this symmetrical arrangement to assure the balance of the system. The great trick is to use the pistons like mobile cores of an electric motor whose cylinder sides constituted the fixed part. By virtue of the laws of electromagnetism, each stroke up and down of the pistons gives rise to an electric current in the cylinder coils. The starting and synchronization of the displacements are also assured electrically.

The duration of the high temperatures is divided by 10 or 20. The volume ratio in the combustion chamber which is 8 on an ordinary car, 12 on a diesel engine, rises to 25 or 27. The Jarret brothers have designed the first engine which deserves the title of "clean" engine.

"If it were only a question of protecting the lungs of our fellowmen, the file would no doubt still be resting quietly at the bottom of the cupboard," Gerard Faul admits honestly. But the inventors realized, as they dug deeper into their concept, that they would also be able to achieve a gain in the yield. This is because the losses of heat are reduced and the combustion is pursued to a greater extent. The progress is spectacular. A gas engine hardly gives in useful energy 30 percent of the energy consumed. With the best diesel engines, we come to 35 percent. Now

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the rectilinear engine makes it possible to reach 60 percent. That is, about double. In this age of costly oil and energy conservation, the matter became very serious.

After making sure that nobody else was on the track, the Jarret brothers carried out a first series of tests in their personal laboratory. But they very soon realized, that the stakes were too great for individual researchers. Before tackling an industry as powerful as that of the automobile, they needed to find important partners.

That is how the file was submitted in 1971 to Gerard Faul, who persuaded the Schneider group to be interested in it. The latter, who remain the majority shareholders, was then joined by the Belgian company La Fabrique Nationale Herstal, later Elf-Aquitaine. On the whole, a sizeable number of billions. Finally, 2 years ago, when the results appeared convincing, the French Government in its turn, came into it, and granted considerable development funds to Mothelec, the economic group especially set up to implement the invention.

Within Three Years?

During the century of reign of the internal combustion engine, it is not the first time that bold attempts have been made to dethrone it. Billions were spent in vain to perfect the Wankel rotary engine. Gerard Faule explains that: "it was based on erroneous physical principles, it increased the thermal losses instead of reducing them." More recently, some people had bet on the fuel battery. They were disillusioned when they realized there was no way of doing without platinum for the electrodes.

Gerard Faul asserts that: "The rectilinear engine does not need any rare material. There is only one noble part, which will no doubt have to be built in titanium for reasons of lightness, the piston. But this is no longer a problem nowadays. Neither does the manufacture need technical skills. It is a very simple engine, containing altogether 30 parts, whereas a diesel engine has 300 to 400 parts. For equal power, it occupies 3 times less space than a classical engine, its consumption is twice as low and causes no pollution. The maximum power per cylinder is about 60 horsepower, but any number of cylinders may be coupled. Finally, it is universal. Today, it burns gas, but may very well operate tomorrow with methane, alcohol, hydrogen."

Well then, when will it be launched? "It all depends what you mean by launching," says an official spokesman of Scheneider. "The transition from the laboratory to the study of the industrial problems or the release of the first electric automobile, if we begin by the automobile? According to the date you refer to, it may range from 3 to 10 years. All that I can say is that the technical problems yet to be solved are now only routine ones. And that we are not in a hurry. We hold the reins firmly. The longer we wait, the more we perfect the invention, and the more valuable it will become."

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But on a personnel basis, Gerard Faul wished to add a few words. "I would be sorry if this engine, whose birth I witnessed, and which is a great French invention, had some day to return to us from abroad. Well, I have to say that so far the foreign industrialists seem so far interested, more prepared to take risks than the French."

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ITALY

GOVERNMENT SUPPORT OF RESEARCH EVALUATED

Rome ENERGIA E MATERIE PRIME in Italian Sep-Oct 79 pp 6, 8

[Text] The question of scientific research is certainly not among those which can become passe. Therefore, let us begin with a few recent events in making an in-depth evaluation of the various aspects of this question.

We are referring to the annual report on the status of scientific and technological research recently presented by the chairman of the CNR [National Research Council] on the one hand and to the many activities and positions taken by the current minister of research on the other.

At this point we are not entering into the merits of the controversies which followed the reading of the report by Prof Ernesto Quagliariello on 19 September in the presence of the assembly of the CNR's advisory committees. We are pointing out only, if still necessary, that disclosure was made of inadequate organizational setups, sporadic courses of action (and always characterized by the aspect of urgency), reduction to almost zero in the amount of responsibility assumed by young researchers, little movement among the researchers themselves and the like. In short, we are calling attention to the usual things which have been characterizing the research sector in Italy for years and which are precisely the opposite of what should be happening.

The fact that appropriations were considerably increased over last year (23.5 percent) can be of little consolation if we analyze how they were distributed (great favor shown to sectors having prestige only or nearly so over vital sectors such as that of energy saving, new energy sources, the geological or agricultural sciences and the like), and especially if we consider that once the funds have been appropriated, we must know how to use them. That is, we must have organizations capable of functioning properly and not bureaucratic apparatuses which absorb substantial percentages of the appropriations themselves.

At this point we should like to mention the activity of Vito Scalia, minister for scientific and technological research, who on more than one occasion has spoken with obvious authority of coordination, of the establishment of secretariats, work groups and the like.

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For example, at the round-table discussion held at the International Center for Theoretical Physics in Trieste on 12 September on "The Contribution of Scientific Research to the Use of Renewable Energy Sources in Italy and Europe," Scalia said that Italy is sufficiently advanced to draw up a national research program on nonrenewable energy sources, "which would have the participation both of major public institutions (ENEL [National Electric Power Agency], CNEN [National Nuclear Energy Commission], CNR, ENI [National Hydrocarbons Agency], IFIM Financial Initiatives for Construction] and the like) and public and private organizations, drawn up by a special work group (with a prior evaluation made in conjunction with leaders of the CNR's finalized project, 'Energetics') whose preliminary action will consist of constructive contacts with industries, labor representatives and regional authorities." "This action," Scalia continued, "should be undertaken within 6 months (one which does not exclude the CNR's 'Energetics') to be submitted to CIPE [International Committee for Economic Planning] by 1980. The same concept was expressed by the minister at the meeting of the Council of Ministers on 14 September in which he proposed that all research activities underway and being carried on by many organizations be coordinated in a National Energy Research Program (PNRE) to be developed in the 5-year period 1981-1985 and in which individual organizations may function in accordance with their respective institutional tasks but in close collaboration with each other to maximize the results over the short and medium term." According to Scalia, the PNRE would require that CNR's plan, already underway, be carried out in the above 5-year period and that CNEN's, ENEL's and ENI's research activities be strengthened.

Lastly, at the 15th International Congress on refrigeration held in Venice from 23 to 29 September, Scalia emphasized that, in order not to lose the benefit of Italy's research effort, all these activities should be coordinated, just as individual priorities should be assigned to new investments according to the technical, scientific or social category involved and the use to be made of the funds.

All of this has been asserted by Scalia without naturally neglecting, particularly in Venice, to deplore the limited responsibilities of the minister for research, auguring the creation of a full-fledged ministry with relative potential both in manpower and means. "There is no organizational development without programing," he stressed, "and the ministry is in serious difficulty if only because it is a ministry without portfolio (that is, not a real ministry [editor's note]) and, in addition, is devoid of offices and duties. Therefore, it is necessary to isolate the more urgent problems in order to update the text of the legal arrangement for the establishment of the ministry itself."

"however," Scalia concluded, "while awaiting such a legal arrangement, we should not lose time." And, among other things, he suggested that immediate effort should be made to come up with at least a "map" of activities already underway or scheduled in the field of research in Italy.

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In short, Scalia outlined a series of activities with which one can agree both from the standpoint of timeliness of action and their urgent need which cannot be delayed.

This having been said, it should be added that close attention should be paid not to be misled by words. We do not want a minister for scientific and technological research if it appears that, in the present situation, the proposals he has advanced risk taking on a fanciful coating or even more. Obviously, we do not want to criticize the Honorable Scalia who, as a politician, does whatever he can with the funds at his disposal, even if his action risks being only a footprint made in the sand by a person passing through a ministry, who therefore acts more out of political opportunism than out of real capability (that is, possibility) of carrying out his responsibilities effectively.

First of all, the solution is to be sought in a genuine political desire (as is customary) to change things. And if that desire exists, it seems to us to be rather lukewarm.

We now have a research ministry without portfolio, which has general powers, purely platonic, of coordination. But obviously, one cannot coordinate without having authority. Thus, it is necessary to concentrate the political moment of research, subsequent to CIPE's deliberations and parliamentary indications, in a single ministry capable of making decisions and exercising pertinent controls. But at this point the discussion takes on a broader aspect, for if we really want to program, we cannot limit the programming itself to applied research, which is occurring in the public sector, and neglect industrial research. Therefore, either the government has the power (which must stem from parliament) to coordinate and, in turn, empower industry (or at least veto or provide incentives and dissuasive arguments) or the whole thing becomes a matter of academic discussion.

It is obvious that industrial research is also to be programmed; but this research is not programmed without programming economic development.

And even with regard to state industry, we cannot speak of programming, if we continue to interweave and confuse the ministry's interventions in state participations, those of industry and the like.

Thus, either there is a definite political desire to do something really new with the Ministry of Research (which, through committees, work groups and the like, would have genuine and specific powers) or we shall continue to play word games. Therefore, it behooves us to be quite clear on another political aspect of the problem: organizational reforms (and that of research, which is closely connected with the university on the one hand and with industrial reorganization on the other, is in that category) cannot be achieved with minority governments which do not have the support of broad majorities involving all the political forces of the constitutional segment.

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ITALY

PURPOSES, STRUCTURE OF SPACE PROGRAM UNRESOLVED

Milan PANORAMA in Italian 26 Nov 79 p 229

[Unattributed Article: "And Scalia Goes Off in Orbit"]

[Text] The countdown has begun. The first Italian space venture should take off before the end of the year and around its launch pad, personified by the minister of scientific and technological research, there is a great coming and going of experts and managers in fields involved in the event. The traffic is directed by Vito Scalia, first-time minister who was able to have the space plan approved by CIPE (International Committee for Economic Planning) (resolved at the end of October), despite pressures by Minister of Budget, Nino Andreatta, and the questions raised by his scientific advisors (Gianpietro Puppi and Giuseppe Colombo).

Scalia considers himself the godfather of a "determinant instrument for the country's future," even though many fear that in the long run the whole operation will result in the creation of a personal center of power for the minister. He is working hard to have ready by December the operational outline to begin the projected expenditure: 200 billion lire until 1983 (with about 300 billion added later for Italy's participation in European space programs).

All these hectic preparations do not necessarily indicate a positive result. Questions about the whole space program posed by experts and party representatives increase with each passing day. The CIPE-approved plan, among others, called for expenditures for research on propellants, for joint NASA programs and experiments on stratospheric balloons, for telesurveying (useful for agriculture, environmental protection, and meteorology), for maintenance of the launch base owned by scientist Luigi Broglio, off the African coast, which is rusting due to salt water, and for the participation in the Spacelab project (a European space lab).

However, the large portion of the expense is earmarked for the construction and launch of an all-Italian telecommunication satellite. Scalia's thesis: in this field, Italian research is advanced, following the completion of

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the Sirio satellite; a new project will help maintain the qualification of the concerned Italian companies (among others Telespazio, Selenia, CGE, FIAR, LABEN) and the use of new technologies in conventional production. The STET Group (financer of the IRI's [Industrial Reconstruction Institute] telecommunications) company managers, those most concerned in the effort, think the same way.

"However, everyone agreed with the fact that research in the telecommunications sector should be under the guidance of an organic project," recall some technicians at the National Research Committee (CNR). "That project does not exist, and the organizations therefore would begin spending public funds with no guarantee of reaching homogeneous objectives." People at the CNR furthermore remember that the satellite called for in the space program is very similar to the one labelled L Sat, which will be launched by the European Space Agency, of which Italy is a member and is paying one-quarter of the expenses.

"The objection is valid. The risk of financing a duplicate is not at all to be excluded," agree those of the PSI (Italian Socialist Party) economic section, "perhaps to mask the government's inability to obtain contracts from the European Space Agency for those qualified industries which go to make up the Italian participation in European programs."

The socialists, among the more vocal critics of the space plan, are waiting to hear from Scalia at the launching of the discussion on the project in Parliament, above all on one point: the management of the 200 billion lire in funds. After the CNR (which was up to now to be the main beneficiary of funds for space research had announced that industrial appliances, or a major part of the plan, were not under its purview, Scalia set his experts to work. The Minister of Research is thought to be studying the creation of an agency under his control, which would also make use of representatives of those companies involved in space contracts. Those at the PSI argue: "A perfect example of a controlled controller which would make the agency Scalia has in mind a nonindependent organism."

The Space Agency, according to the socialists' proposal, should be, therefore, an exclusively technico-scientific organization, independent from industry (allowing then expansion of its experience to the field of aeronautics), based on the French model, or on the American NASA model, which have shown that they work very well.

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ITALY

MINISTER DISCUSSES ITALY'S SPACE PROGRAM, ROLE IN ESA

Paris AIR & COSMOS in French 1 Dec 79 pp 43, 45

[Interview of Vito Scalia, Italian minister for coordination of scientific and technological research, by Jean de Galard--date and place not given]

[Text] For some time already Italy has established a true space plan, which the vicissitudes of political life and changes of government have contributed to delaying, modifying, and deferring.

Since his entry into the Italian government in August 1979 as minister for coordination of scientific and technological research, Vito Scalia, Christian Democratic deputy from Catania, Sicily, had set for his first task to have this plan adopted--in a form little different from its original form--by the CIPE (Interministerial Committee for Economic Programs) and to assure its beginnings in the first 3 months of 1980. Adoption of the Italian space plan covering the 1979-1983 period was achieved last 25 October and the minister must this month establish the broad outlines for administration of this plan. In confirmation of its international audience (which recently led to its receiving an exclusive interview with Frans Swarttown, president of Fokker), AIR & COSMOS has succeeded in obtaining an interview, also exclusive, with Minister Scalia in which, as shall be seen, he is not content with merely analyzing the broad outlines of the Italian national space plan. He takes a firm stand against the status of "poor relation" in which he considers his country now finds itself within the space domain.

On the day of this interview--22 November 1979--Scalia had occupied his ministerial office for precisely 100 days, AIR & COSMOS, in expressing its thanks to him herewith, also extends its warm wishes for the success of his mission.

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[Question] What is the significance of the new Italian Space plan at the scientific and industrial level?

[Answer] First of all I would like to emphasize the political and economic aspects of this space plan for my country.

After many years during which specific program orientations were lacking I considered that one of my first tasks as the head of the scientific research ministry--a position which I have held since last August--was to assure launching of the Italian "space plan" which previously has only too much suffered successive delays and postponements.

I was particularly anxious to see to it that there be no widening of the technological gap which Italy, up to now, has been compelled to let arise between it and other countries more highly developed.

Certainly it would seem that past experiments were positive but the true political and technical problem consists of developing, extending, and improving them.

I think that is where my task as minister lies, rather than having to effectuate technical matters, which must always in all ways be effectuated as a function of political and economic considerations which are much more vast and general.

Consequently I decided to submit the space plan for the approval of the members of the CIPE, and it is my pleasure to state that it has received the approval of all the ministers who constitute the CIPE.

[Question] What does this plan contain?

[Answer] The purpose of this plan is to establish space policy objectives defined as priority objectives, to establish the cost of their realization, that is, to predict the financial allocations necessary, and to establish the various phases of realization of those objectives over a period of 5 years. The amounts necessary for realization of those objectives--the most important of which are those related to basic research, feasibility studies, and the base which we have in Kenya--are greater by far in total than the expenditures provided for construction of a telecommunications satellite, a pre-operational model of which will be built. As a matter of fact, of the 98 billion lire planned to be budgeted for the first 3 years of the plan, 50 billion are allocated to the "Telecommunications" section; that sum also covers the basic technological studies.

This plan, I must say, is characterized particularly by its flexibility. It contains indeed not a single method of approaching a technology which in every way is continually, and sometimes very rapidly, developing. Above all, its flexibility offers the advantage of ability to correct theoretical lives of direction or political orientations which may in the end prove dangerous to the extent that they may come to be outmoded.

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In fact, as everyone can see by examining the table of figures [source p 45] which summarizes the broad outlines of financing the space plan, the latter, even though quinquennial, contains figures for each of the approved sections for only the first 3 years. Continuation of their financing for the last 2 years of the plan's effectiveness will be provided only if scientific and technical controls have confirmed their merits.

It is obvious that such controls must to the maximum extent take into consideration the international collaborations which we shall seek to increase and strengthen.

The Italian Space Plan
(Billions of lire)

	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
Basic scientific and technical research	4	4	4		
Kenya base and Center for Aerospace Research	3	2	2		
Space Lab Program (3 payloads possible)	1	3	3		
ITALSAT TLC telecommunications satellite	15	16	21		
Observation	2	2	2		
IRIS (propulsion and auxiliary systems)	2	2	3		
Feasibility Studies	<u>1</u>	<u>3</u>	<u>3</u>		
Total	28	32	38		
Grand total: 200				102	

[Question] What can you say about the administration of this plan?

[Answer] I have made a formal, personal commitment to the CIPE to present, no later than 31 December--and I hope to be able to do so even sooner--concrete proposals for operational management of the space plan and to provide effective harmonization of all space activities, whether they be national or international, in which our country is involved.

There I believe we have the surest method of transforming the financial effort we are making in this sector into a lasting reality for our scientific research and also, in consequence, of assuring our presence and credibility in the space domain at the national level and at the international level.

[Question] Does Italy have Space Shuttle projects?

[Answer] Here again, it suffices to refer to the table of figures related to financing the plan. It includes a section of expenditures titled "Propulsion and auxiliary launch systems." In the case it is the IRIS (Italian Research Interim Stage) which is none other but a propulsion system of Italian design enabling medium loads to be placed, from the orbit of the Space Shuttle, into the geostationary transfer orbit. NASA is interested in our program which can contribute to extending the range of the propulsive systems made available to Shuttle Customers. Its interest, moreover, is in the course of being made definite with the efforts we are exerting to

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arrive at an Italian-United States collaboration program for qualification of the IRIS.

[Question] Does Italy have projects related to direct television? Does it expect to lease channels or to have its own satellite?

[Answer] Italy is fully able to develop a direct television satellite and, actually, the space plan in its original form contemplated it. But the conversations which we had last year with the Federal Republic of Germany have led us to make the following choice: telecommunications within a national framework, and direct television weaken the framework of a possible European collaboration program.

[Question] How will this national space plan harmonize with Italy's commitment to the ESA [European Space Agency]?

[Answer] There you have hit upon the crucial point in my entire policy line and I am glad you asked me that question. It is indeed obvious that in this domain national activities are essential to make the country's various industries credible at the international level. It is no less obvious that international cooperation constitutes a valuable stimulus and serves to function of a "booster" for national activities.

Very well then, and in that is the crucial point I mentioned a moment ago. I state, with the figures and proof in my hands, that my country has allocated too little for expenditures of national scope but has, in contrast, allocated "too much" for the European Space Agency. When I say "too much," of course, I am thinking of industrial compensation which, for my country, has been unbelievably small; I state this without fear of contradiction. I have already emphasized this in international circles, I have already stated it to Mr Gibson and I shall not grow tired of repeating it so long as a means of rebalancing the situation has not been approved.

I shall not deviate from such a position; my attitude is firm and I visualize no possible compromises or attempts at mediation.

[Question] Then how is the problem of financial participation in the ESA to be resolved?

[Answer] As far as we are concerned we do not desire--it should be superfluous to mention it--merely that agreements made freely, honestly, and with complete community of viewpoints be respected. We consider that above all else within the framework of European organizations it is inadmissible that there be perpetuated situations within which there exist, among the various member countries, the "rich" and "poor."

We are therefore partisans of putting into practice economic policies which will encourage international cooperation instead of discouraging it. At the present time what is most clear is that the nations which have benefited

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most from the ESA in the years past can today enter into bilateral or multi-lateral agreements outside of that very same ESA, thus draining European programs of their significance and substance.

I repeat, there we have a situation which Italy cannot tolerate for long. I have already said very frankly that in the event this situation continues my country shall feel compelled to revise, from the very foundations, its position with respect to the ESA.

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ITALY

INDUSTRY PUSHES RESEARCH ON ELECTRIC CAR, SUPPORT SYSTEM

Milan CORRIERE DELLA SERA in Italian 28 Nov 79 p 25

[Article by Carlo Monotti: "Urban Transport Is Converting to Electric Power"]

[Text] Alfa, Fiat, Ansaldo, PGE [Ecological Management Projects], Fiamm, and Marelli have asked the IMI Fund [Italian Credit Institute] for financing to build 50 prototype vehicles for various uses.

Rome--Ten ENEL [National Electric Power Agency] electric vans built by Fiat were recently put into service in Milan. Others will soon follow them throughout Italy. But at the beginning of the 70's, the U.S. Postal Service began using electric powered vans as preferred equipment: they do cost more, true, but they need practically no maintenance (nor, moreover, do they make noise or pollute).

For Italy, producing and consuming industries (ENEL [National Electric Power Agency], SIP [Italian Telephone Company], the post office, and others) have set 1985 as the year that electric-motor industrial vehicles will go into urban use. To achieve this goal, Fiat Alfa Romeo, Ansaldo, PGE, Fiamm, and Marelli have asked the IMI Fund for industrial research to finance a coordinated program that will build 50 prototypes for the most varied uses (taxis, ambulances, street-cleaners, etc.).

Whoever desires an electric car in Italy today can turn to Piaggio, which has already sold an electrical version of the Bee in several dozen models. At a steady speed of 45 km/hr, the electric Bee costs much less in energy than the traditional Bee, but it costs rather more per kilometer and sells at three times the price of the normal version with a two-stroke gasoline motor.

There are essentially two problems that Piaggio intends to solve in conjunction with the other Italian manufacturers: the very high cost of the electric motors (Bosch) and the relatively high cost of the regulator. Mass production should bring these costs down significantly. The problem of the batteries is more complex.

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It is said that lead batteries are hindering the implementation of electric automobiles in terms of both cruising range and cost. The new nickel-zinc and ferronickel batteries should double the present cruising range, and the batteries that General Motors is experimenting with should bring it to more than 200 km. The Bee's present lead batteries have an average life of more than 400-500 charges, which means they have to be replaced every 36,000 to 40,000 km. The 12 of them cost on the order of millions of lire. The new lead batteries that Fiam will market next year will take 800-900 charges and thus make it possible to lower this cost.

Up to 1900 the promoters of the automobile were divided into two categories: those who predicted the triumph of the electric car and those who bet on the heat engine (steam, liquid fuels, etc.). The oil crisis has given new life to the electric motor not only for its environmental advantages (it makes no noise and does not pollute) but also for its versatility with respect to primary energy sources. Electricity is not actually a source but an "intermediate" form of energy; for that reason, an electric car might be powered in a perhaps not too distant future by wind (air-powered motors) or by solar power linked to normal batteries.

Stagecoach

The biggest problem to be overcome is that of the assistance and recharging infrastructure, which, for all practical purposes, has yet to be invented. Indeed, the gas pump made it possible for the present-day automobile to win out over its rivals at the beginning of the century.

In its study of the infrastructure for the electric car, the PGE company of Milan is out in front of the rest of the world. For example, the PGE is outfitting a rental station (and the vehicles) for the city of Brussels as the basis for a project by the University and the community intended to increase gradually the use of electric vehicles in the city center (an initiative like one in progress in Amsterdam and like studies being made in Florence and Pavia).

In practice, the PGE's infrastructural design is very reminiscent of the stagecoach. The simplest system would be to replace batteries at new post stations, as tired horses used to be replaced. But in this case, it would be necessary to check the condition of the batteries that are left and those that are taken, unless the whole system is based on rentals. This is the PGE's conclusion. In that case, instead of changing the batteries it would be even simpler to exchange the car, which would then be recharged by being plugged in at the station.

Obviously, this infrastructure must solve some very specific problems at the outset, such as traffic in historic centers (city taxis without drivers) or traffic in congested tourist locales. But if it does get off the ground, it will be an experiment for a possible new system where you can pull in next to the gas pumps and fill it up by "plugging in."

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ITALY

NEW ALFA ROMEO AIRCRAFT ENGINE SUCCESSFULLY TESTED

Milan CORRIERE DELLA SERA in Italian 27 Dec 79 p 8

[Article by Franco Gonzaga: After Thirty Years the First Alfa Romeo Engine Has Flown]

[Text] The first aircraft engine produced by Alfa Romeo after the war, a 700-horsepower turboprop, completed its test flight on Christmas eve at Pomigliano d'Arco (Naples). An unlikely day, but the aviation division of Alfa Romeo, especially its director Focacci, had made a kind of sacred commitment that it would fly before the end of the 1970's. The turboprop engine, mounted on a Beechcraft King Air twin-engine aircraft that was piloted by test pilots of the experimental department of the naval air branch of the Air Force at Pratica di Mare, performed well in the test, and at Pomigliano engineers and technicians are celebrating.

The history of this medium engine that weighs slightly more than 140 kilograms began 7 years ago with a program in which Alfa Romeo and Rolls Royce participated. "In the last 3 years," states engineer Focacci, "the participation of our British colleagues has been reduced to the point that we have worked on it entirely by ourselves for the last year." Still the engine was completed about 3 years ago and since then, built and mounted in three prototypes, it has undergone more than 700 hours of testing before finally leaving the ground. It is perhaps not appropriate to go into technical details here, but it can be said that it is of modular construction, that it has a single shaft, and a single annular combustion chamber with single-stage compressor and two-stage turbine.

It was originally designed as a simple turbojet, but later designed for great flexibility of employment, from turboprop to turboshaft for helicopters to a development of the first model for medium-jet aircraft.

The first flight having been made, there is obviously still a long way to go: the schedule provides for certification in 1982 and the beginning of industrial production in early 1983.

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The uniqueness of this engine, the designation of which is 318, can be quickly stated: it is the first European medium engine designed in accordance with the low-cost philosophy. Low purchase cost (compatible with the volume of technological investment) and low operating cost. The design ab initio of a modern aircraft engine (jet engine, obviously) involves unbelievable investments: something like 1 million dollars. This Alfa Romeo 318 alone, according to engineer Focacci, has cost "several tens of billions of Italian lire." It is calculated that it may be placed on the market at a price 25 percent below those of the American and European competition. The modular construction is already a major specific factor in this low-cost technical philosophy. Naturally the 318 was not developed without a market study that took 3 years. It is intended for the new executive and commuter turbo-prop aircraft falling within the weight range of 2,000 to 3,000 kilos. This is a class of aircraft that seems about to undergo a revival thanks to flexibility of operation (short runways, semiprepared airfields) that is impossible for standard aircraft and not cost-effective for the old piston (and gasoline) engines.

In Italy interest in this engine has been expressed by Aeritalia, which has in the planning stage a commuter aircraft (medium craft for short trips at high cruising speed); the Agusta group for a Siai Marchetti trainer; Aermacchi for a future executive aircraft, and Partenavia. Among the foreign aeronautical firms, those in Sweden and Australia especially, for equipping training aircraft. Finally, it is intended for the so-called emerging countries precisely due to its price and operating cost economy as well as its simplicity. At Alfa Romeo they point out that the flight program has been made possible by the valuable assistance of the experimental department of the Air Force.

With this very new Alfa Romeo 318 engine that is entirely Italian built and almost entirely Italian designed and developed, the firm is putting the name of Italian industry back in the difficult world aviation market for the first time since the end of the war. But Alfa has an old tradition in this sector, a tradition of experience rather than original design, we might say, but still extremely important.

The first Alfa engine to leave the ground was a 24-HP automobile engine mounted in a biplane that the pilots Sansoni and Franchini flew to Taliedo (Milan) way back in 1910. During World War I 100 engines were produced by the Portello establishments under the Isotta Fraschini license for military aircraft. Then after a period of inactivity it was resumed in 1924 under the British licenses of Bristol and Armstrong-Siddeley. With a Pegasus engine (Bristol license) and a Caproni aircraft, Renato Donati set on altitude record of 14,500 meters on 11 April 1934.

The first original Alfa Romeo engine goes back to the 1930's and is attributed to engineer Jano: the 250-horsepower D.2.

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SWEDEN

SWEDISH FIRMS INCREASE SPACE TECHNOLOGY CAPABILITIES

Stockholm VECKANS AFFARER in Swedish 8 Nov 79 pp 34-35

[Article by Per Stromberg]

[Text] If it becomes a reality the Nordic TV satellite could mean orders totaling 2 billion kronor for the Swedish technology industry. But even more important the satellite could become a reference object. It could open doors to the European and international space market for LM [L. M. Ericsson Corporation] and Saab.

When the first of the Nordsat project's six to eight satellites is sent up by the European Aerie rocket from the Devil's Island region of French Guiana in 1986 it will be the fifth in a rapidly growing string of geostationary TV satellites over the equator transmitting to Europe. By 1983 the German-French space cooperation should have born fruit in the form of two TV satellites apiece and it is expected that German color channels will reach 75 percent of all Swedish households.

The Nordsat project which includes a 20-year cost estimate starting in 1980 has a budget of between 5 and 6 billion kronor. The cost spread depends on the extent of programming, especially with regard to translated programs. Cost distribution will be one of the main topics in the round of negotiations scheduled to begin in the fall of 1981. All this is based on the assumption that the Nordic Council session of February 1981 gives its approval to Nordsat.

"Half of the space program's 4 billion kronor will go to Sweden. This means an annual Swedish contribution of 100 million kronor. No one is saying that Nordsat should go up for industrial policy reasons but if the project becomes a reality it will mean a big opening for Swedish industry in the space sector. Therefore it is our line that Sweden

should maximize its interest in Nordsat," said Fredrik Engstrom, executive director of the state-owned Space Corporation. As the only Nordic space organization the Space Corporation will occupy a unique position when it comes to influencing purchases. In addition Nordic industries have united in NIG (Nordic Industrial Group), in which two firms from each country participate in the project's development and production. Saab and L. M. Ericsson are the Swedish representatives--they will also have an important role in the Nordsat project.

Up to the time when the first Nordic TV satellite lies 36,000 km above the equator the project will have taken 750 million kronor. After that another two satellites will be sent up at 6 month intervals, the last one to serve as a passive reserve. Their lifetime is estimated at 7 years after which the satellites will be replaced by three new ones that will last throughout the cost estimate period, in other words to the year 2000.

A schematic breakdown of establishment costs shows that the satellites' communication systems will cost 100 million kronor apiece with a large part of them constructed in Sweden, mainly by L. M. Ericsson. The other half of the satellite cost comes under the power and maneuvering system. A possible supplier: Saab together with its foreign cooperating partners. The cost here will be another 100 million kronor per satellite. It will cost another 150 million kronor per satellite to get them into space and in position with the help of the Aerieane missile (which Volvo and Saab have partial orders for).

The ground-based system consists of a control station costing 50 million kronor which could be located in Esrange, Kiruna. In addition there will be ground-based stations for each TV company at a cost of 5 million kronor apiece.

Saab the Major Contractor?

What do LM and Saab expect to get out of the Nordsat project? The two highly-developed technological companies have already made their mark in the space sector. Most recently Saab obtained an order last month worth 15 million kronor for the French Telecom 1 and before that acted as supplier to European Teleunion's nine telesatellites through ESA (European Space Agency). Saab sales total 25-30 million kronor a year in the space sector. In the past data processing has been its specialty but likely development areas are power and guidance systems along with total contracts, at least that is Saab's own view. Both the Space Corporation and LM feel that Saab is an obvious choice as major contractor for Nordsat. "If we assume that Saab is given a coordinating function it would be reasonable to assume that we will get at least half the manufacturing work," said Ingemar K. Olsson, head of Saab's missile and electronics

division. He emphasized that Nordsat will create opportunities for Saab to participate in international space projects.

L. M. Ericsson has sales of 10-15 million kronor per year in the space sector and just recently got its fifth contract in a row from ESA for antenna systems for scientific satellites. Three of these are already in position out in space. "Obviously LM is interested in controlling the space aspect of communications systems too but our major target is the ground-based equipment in the space project," said Gunnar Wennerberg, head of the civilian products section of the defense electronics division. "In telesatellites alone there is a potential market of several billion kronor during the 1980's. It is equally reasonable to assume that our share of the market will correspond to our share of the telephone components market. That would mean about 400 million kronor." Nordsat--which is not a telesatellite--could give LM an important domestic market for antennae and microwave equipment. "We could count on 40 million kronor per satellite and we would obtain references that would help us get in on international projects," said Gunnar Wennerberg.

The research and development underlying the ability of LM and Saab to embark on a TV satellite project will be financed largely by state funds. In the spring a space bill was introduced which will double the Swedish space budget to 200 million kronor. Most of the money will be spent to increase expertise in Swedish industry.

TV Manufacturers Waiting on the Ground

Satellites are the tip of the iceberg, especially when telesatellites are concerned. The big money is down on the ground in the form of transmitting stations and other telecommunications equipment. But the space aspect is the key to other business deals. "One must have very good reasons for getting involved in the international space market," said Fredrik Engstrom. "Our trump card is the domestic market we can now offer the European space firms, Aerospatiale, MBB [expansion unknown], Dornier and British Aerospace in the form of Nordsat projects. In return we should be allowed to take part in foreign space projects within the areas in which we have developed great competence. If this works out it should mean space orders of close to a billion kronor for Swedish industry within the next 7 or 8 years."

Bert Levin, one of the Nordic undersecretaries who recently issued the final report on Nordsat: "The total cost divided up among the 7 million Nordic TV license owners over a 20-year period would be 33 kronor per year. For that amount a Swede would receive another five TV channels. Considering the fact that the license tax for color TV is 480 kronor a year, the ratio is striking." In addition to the collective aspects of the project there is also the consumer side. The studies of the Space Corporation indicate that between 1500 and 2000 people would be employed in Sweden in connection with antennae and TV adapters if Nordsat goes up.

Both Philips and Luxor estimate that the market will start as early as 1983 when the German satellite transmissions start. "We assume that market penetration will be similar to that of color TV. This would mean that in the 2 years after Nordsat is sent up there would be 50,000 sets that can receive the transmissions," said director Bjorn Nilsson of Swedish Philips. At Luxor executive director Ake Johansson estimated the size of the market and assumed that private homeowners will pay up to 3000 kronor while tenants will pay only 1000 kronor for antennae, adapters and installation. "Obviously Nordsat would mean a lot of money for the branch, probably close to 3 billion kronor. But even if the project does not go through people will be seeing satellite TV in this country."

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